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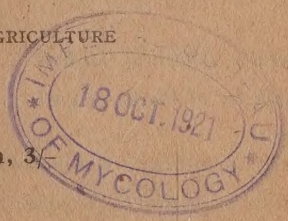

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DEPARTMENT OF AGRICULTURE.

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EDITORIAL NOTES—JULY, 1920.

Mr. H. W. Simmonds, Entomologist, returned from Tahiti by the s.s. "Mokoia" on 31st July bringing with him a final consignment of parasitised coconut scale. His report appears in this issue from which it will be seen that one parasite has been successfully introduced, in limited numbers it is true, but it is clear that the difficulties surrounding the introduction of the parasite are not insuperable. The Legislative Council will be asked to vote a further sum for a repetition of the visit to Tahiti, and as it will be carried out, if approved, during warm weather, the chief difficulty experienced during the previous trip will not recur. Mr. Simmonds when in Rarotonga investigated the fruit-fly pest and his report contains an important reference to the possibility of obtaining a modification in the restrictions in New Zealand against the importation of citrus fruit from Fiji. Action is being taken with the view of attaining this object, which would open up a new market for Fiji citrus fruit and thus encourage development of this useful industry.

The work of establishing dairy farms under the Tailevu Dairy Scheme for Returned Sailors and Soldiers has commenced. The selected men almost unaminously desired to commence work at once on their farms instead of going for a period of instruction in Australia, and negociations are proceeding for obtaining the services of an Instructor when one farm has been completed. Plans for the factory are completed and Mr. W. Clifford has been despatched to New Zealand and Australia to enquire as to suitable machinery.

The possibilities of cotton growing are being considered with some enthusiasm by a number of planters and prospective planters, and the Government has secured a supply of seed in the West Indies. The reason for high prices of Sea Island Cotton is to be found in the declining production in the United States of America. The *Weekly News Letter* issued by the United States Department of Agriculture says that for the 10 years ending 1916 the average annual production of Sea Island Cotton was about 90,000 bales. The production of Sea Island Cotton in 1918 was about 40,000 bales and the estimates for 1919 are 20,000 bales.—(*Colonial Journal*, April, 1920).

The following extracts from the same number of the *Colonial Journal* will be of interest to prospective cotton growers:—The Empire Cotton

Growing Committee puts in the foreground, in submitting its report, the need for research and for great addition to the Agricultural departments of the colonies. The Committee suggests that the Imperial Treasury should assist colonial governments, by grants and guarantees, to provide funds for public works, such as railways, waterways, irrigation and harbour works, necessary for the development of their resources. The *Colonial Journal* suggests that the door of the Treasury will probably be closed against application of this kind, but commercial prospects now justify a bolder policy in the tropical colonies. An announcement was recently made, following an exhaustive investigation, that the cultivation of Sea Island Cotton will be practically abandoned in Florida and Georgia. After considering the report of the Committee, the Home Government decided to ask Parliament to vote £10,000 a year for five years to enable the Committee to develop its work. Great Britain paid to the United States last year about £125,000,000 for cotton, the imports annually being about four million bales and worth about £150,000,000."

LIVE-STOCK INDUSTRY IN FIJI.

By W. Rainey.

In this final report I have endeavoured to the best of my ability to deal clearly and truly with the following matters:—

I.—The Present Circumstances of Cattle Production, Grazing, and Trade, in Fiji.

II.—Concrete Proposals arising out of my Investigations.

III.—Reasons why Other Proposals contained in former Reports have been abandoned.

IV.—The Extent and Distribution of Animal Diseases.

V.—A Fore-cast of the Development of the Live-stock Industry in Fiji.

The report deals chiefly with cattle, because as regards the other sorts of live-stock it seems unnecessary to add much to what has been stated in former reports, and because many of the observations apply to domesticated animals generally.

There is some repetition of suggestions already made in former reports, because otherwise it did not seem possible finally to present the subject in its proper perspective.

Section I.

The Present Circumstances of the Cattle Trade.

My estimate of the approximate numbers of live-stock in Fiji is:—

Cattle	80,000
Horses and mules	10,000
Sheep	1,000
Goats	6,000
Pigs	4,000

	Per annum.
Birth-rate of cattle	10,000 calves.
Killed for meat or exported	4,500 cattle.
Deaths from old-age, disease, and Fijian slaughter	3,500 ,,
Net increase	2,000 ,,

The above figures have been calculated on a necessarily incomplete basis of fact, but it is thought that they may be taken as a reasonably safe guide in the absence of accurate statistics.

It is assumed from the figures that, so far as meat is concerned, the supply exceeds the demand, and that consequently the price to the grower will be low; but it also appears that there is not enough material in excess at present to supply a large export trade of live beasts or frozen meat.

The position appears to be that of a vicious circle; the trade is waiting for production and production is waiting for the trade.

In relation to the estimated cost of clearing, cultivating, fencing, and weeding, it is not profitable for Europeans at the present price of beef to develop further land for cattle production except as a side-line on coconut plantations.

The supply of cattle is being kept up and increased by the Indian small-holder, who on an average has two cows and two working bullocks. He displays great industry in maintaining this stock, sparing no pains to ensure that they are fed; the production of calves in excess of his requirements or feeding possibilities is mainly responsible for the credit balance in the account of the cattle trade in Fiji to-day.

The prices paid for beef (live weight) vary in different parts of the group, from 25s. to 35s. a hundred pounds for bullocks or barren heifers. The average weight of a 3–4 year old bullock in Fiji is 500 pounds, consequently the average price for the beast is £7 10s. at Suva or £6 5s. at Lautoka.

The average carrying capacity of the best flat land in the wet belt of Fiji is a beast to the acre, so that about three acres are required to produce, by breeding, one 500 lb bullock per annum, *i.e.*, a gross return of £2 10s. per acre per annum, not an attractive proposition in a weed-ridden tropical country.

The grazier who buys big-framed store bullocks and cows of mature age from Indian small-holders for about £5, or less, each, and fattens them in six months to weigh 700 lb, can do much better, and as a fact this is the only sort of cattle farming that is a payable proposition for the European in Fiji to-day. It is unfortunate for the quality of meat that this is so, because old cattle fattened up do not make tender beef.

Graziers are established on the Rewa River, on the Navua River, and elsewhere; a few are doing well and their only danger is over-stocking. It is significant that at present the only really successful self-supporting grazing farms are found on river flats in the wet belt with Para grass for pasture. There is scope for more graziers on this class of land, but not for many more because the success of the undertaking depends on the purchase of cheap store cattle from Indians, and this source of supply is not inexhaustible.

For the most part, grazing operations in Fiji are carried on in a reckless style. An area of river-side flat, growing Para grass, is acquired, is roughly fenced into a couple of paddocks, and is heavily stocked with all sorts of cattle. So long as the Para grass holds out, all is well, but when it is eaten out and trampled down, weeds and worthless herbage appear, and the bottom falls out of the undertaking. There are few exceptions to this ending, and that is why there will always be a fair living for a scientific grazier on good river-side Para-growing land in the wet belt.

It would be difficult at present to make a success of cattle farming in the dry belt of Fiji, because a European grower must be prepared to sell his store cattle at the low market rate set by the Indian small-holder, and by the price of beef, and there are not many available areas in the dry belt where cattle can be fattened without hand-feeding.

With the exception of the upper part of the Sigatoka River and limited areas elsewhere, no land of any real value for grazing is presently obtainable at reasonable cost in the dry belt, and certainly none that would pay for fencing and weeding.

To sum up, the position in Fiji at the moment is that there is a fairly good opening for a few good graziers with capital, provided that they can secure first class river-side flat land growing Para grass in the wet belt; and that so far as the profitable breeding of cattle as a self-supporting industry is concerned there is no opening at all.

The financial possibilities of dairying in Fiji are to be put to the proof by the Returned Soldiers and Sailors scheme, so that it is not necessary to do more than to express one's faith in those possibilities, certainly to the extent of meeting the internal requirements of the Colony for fresh butter.

It is not likely that Fiji can compete in world-markets on level terms with temperate-climate countries, in the export of butter, because the flavour of butter depends upon subtle influences of herbage and bacteria that do not obtain in the tropics; consequently Fiji butter must be inferior in this respect to that for instance of New Zealand. It is as well frankly to face a fact of this sort.

The popular view in Fiji is that milk produced in the Colony is deficient in butter fat and that on this account the chances of successful dairy farming are not good, but the recent work of the Government Chemist (who has analysed a large number of samples of milk), appear to show that this view is fallacious. On the contrary the results obtained by him appear to show that, although the volume of milk is lesss, the percentage of butter fat is actually higher than could be obtained from a similar class of cow under similar conditions of feeding in temperate countries.

It is desirable for a proper appreciation of the present position of the cattle trade to refer to the enterprise of Messrs. Sunderland & Co. of Suva. This firm, by applying modern methods to the conduct of its business, has built up an important trade in the victualling of ships with fresh meat, an asset of constantly increasing importance in a Colony where the home consumption of meat is necessarily small, and whose maritime prospects are favourable. In addition the firm has acquired a considerable area of good cattle country in the provice of Ra, where the experimental breeding of Indian cattle under proper farming conditions is to be carried out on a large scale.

On an island of about eighty acres on the Rewa River farmed by Mr. J. J. Barker, a model demonstration is given of the great value of *Panicum molle* (Para grass) when scientifically handled.

It is true that Messrs. Sunderland & Co., being a firm of butchers, alone under existing conditions can afford to develop land properly for the production of beef and for experimental breeding, nevertheless their enterprise is and will be of great value to the Colony as a whole, a fact which must be set against the tendency to a monopoly in the cattle trade.

Practically the only export trade of live animals from the Colony to-day is the shipment of a few bullocks each month to butchers at Tonga and Samoa. With the exception of two shipments of bullocks to Sydney some time ago, there appears to be no one enterprising enough to try the Australian markets. There are many difficulties: the provision of fodder for the voyage from a country where baled hay or straw is unobtainable; the danger of strong commercial opposition in Sydney; the law that cattle must be slaughtered within a limited period after arrival; all these considerations combine to damp enterprise.

An important circumstance affecting the stock industry in Fiji is the remarkably small progress that has been made in the cultivation of good grasses. At the present moment the only payable pasture on a practical scale in Fiji is Para grass growing on alluvial land. One hears much of Paspalum grass in Fiji, but one sees very little evidence of it, and that evidence is not all in its favour. Personally I think that the matured experience of the future will altogether reject Paspalum in Fiji in favour of grasses better suited to local conditions, and that these grasses are likely to be of the Panicum family. With the exception of a small-leafed trefoil, Para grass, Guinea grass, and an upland variety of Panicum in the dry belt, there appear to be no grasses growing and propagating naturally in Fiji that are worth cultivating. Buffalo grass has been introduced experimentally and appears to do well; Rhodes grass is also being tried. Sensitive grass is useful in some places as a supplementary feed, but in other places

the cattle absolutely refuse to eat it; in any case it is not a satisfactory fodder for winter keep.

The impression that the Panicum family will be found most suitable for cattle grazing on all levels in Fiji is based upon the following facts:—

1. Para grass, the best existing feed in Fiji, is a Panicum.
2. A variety of upland Panicum, accidentally introduced into Fiji, has taken hold without any cultivation or assistance over considerable areas in the districts of Lautoka, Ba, and Tavua, is preferred by stock, and forms a thicker better sward than any upland forage grass hitherto existing in the Colony.

It is not necessary or desirable to restrict enterprise to a single grass or family of grasses, but it is essential to have at least one suitable pasture grass for permanent grazing. Guinea grass, Rhodes grass, Sudan grass, and Buffalo grass, are all desirable auxiliaries and should all be planted, but there should be a basic sward of permanent pasture on most of the available land, and it does not appear that any hitherto tried grass except a variety of Panicum is likely to fulfil this condition generally throughout the Colony.

Section II.

Concrete Proposals arising out of my Investgations.

These may be subdivided into:—

A.—*Proposals to which effect has already been given, namely:—*

(*a*) An Ordinance to regulate the Transport of Cattle by water.

(*b*) An Order in Council making adequate regulations under the Foreign Animals Importation Ordinance, to safe-guard the Colony from the introduction of animal diseases.

(*c*) Regulations for the humane slaughtering of cattle.

(*d*) The declaration of tuberculosis as a contagious and infectious disease of cattle.

(*e*) Arrangements for establishing a quarantine station for animals at Suva.

B.—*Proposals which may require new legislation to which effect has not yet been given.*

(*a*) An Ordinance to regulate the Overland Transit of Cattle.

The case for this Ordinance is given in my report on Colo North, and is quoted here for easy reference:—

"It is estimated that during the past six months more than 2,000 cattle have passed through Tavua *en route* to the Rewa district *via* either Nadarivatu or Penang. Colo North and other districts in transit are affected as concerns their roads and grazing grounds as well as by the likelihood that, at some time or other, confusion, either accidental or intentional, may arise between the identity of the travelling cattle and animals the property of persons on the trade routes. To obviate this risk it is suggested that any person intending to travel cattle overland from one district to another should be compelled to obtain from the police a way-bill setting forth his name, address, number, and description of cattle, their place or origin, and their destination. This way-bill would be checked and countersigned at each police station *en route*. Such a procedure is enforced in Australian States, and I am of opinion that it should be introduced into Fiji not only to safeguard owners of stock, but to provide means of knowing what movements of cattle are taking place.

"It would be well for the Fiji Government (unless the papers are already in their possession) to obtain from New Zealand, Queensland, and New South Wales administration, copies of their stock way-bills together with copies of the regulations affecting the overland transit of stock in order that, with these publications as a guide, there may be drawn up what is requisite for Fiji."

The suggestion might be referred in the first instance to the District Commissioners and Inspectors of Constabulary in the districts concerned, before the proposals are considered for purposes of legislation.

(*b*) An Ordinance to provide for the Registration, &c., of Proprietors of "Gates."

An extract from the report on the Ba district is appended to show the reasons for this proposal, which might also be referred to local authorities concerned in the first instance.

"16. Large areas of the foot-hill land are appropriated for native cattle runs or 'gates,' as they are locally termed.

"17. A 'gate' consists of a rough barbed-wire stockyard placed adjacent to an unfenced cattle run of up to 10,000 acres running a mob of up to 500 cattle.

"18. The owner or keeper of the 'gate' receives cattle as boarders in return for a weekly payment of about sixpence a week from landless natives and runs them with his mob. In most cases it appears that the 'gate' proprietor keeps no books and gives no descriptive receipt, so that a beast once admitted to the 'gate' may ultimately be restored to its owner—and may not. Of course this free-and-easy arrangement leads to trouble and often involves grave suspicion of fraud. Most of the 'gate' cattle inspected by me were in poor condition.

"It would seem advisable to introduce legislation providing for:—

"1. The compulsory registration of 'gate' proprietors.

"The issue of receipts for any cattle the property of other persons taken into the run.

"3. The keeping of adequate descriptive records of stock in hand and of stock issued and received."

C.—*Proposals which may require the amendment of existing Legislation and Regulations.*

(*a*) In Ordinance No. XXI of 1909, the Stock Improvement Ordinance of 1909, it is recommended to delete all references to Bulls.

It is my carefully considered opinion, after many months of personal administration of this Ordinance, that as regards bulls the existing legislation is impracticable, and that it has done and is doing more harm than good. My reasons are:—

(1) A number of lay Inspectors would be required properly to carry out the Ordinance as regards bulls.

(2) The effect of the Ordinance is to reduce the number of bulls below that required in the Colony.

(3) No one is competent to judge as between ordinary bull calves of six months which will be the most satisfactory sire, *i.e.*, which should be spared and which castrated.

(4) The Ordinance as regards bulls serves no useful purpose in a Colony where the standard of cattle is as a rule on the same level, where as a rule one bull is as good as another, where the principal cattle owner (the Indian small-holder) usually declines to take out a licence for bulls and cannot afford to import bulls

to replace those castrated, and where it would not at present be practicable to establish state-owned bulls for the use of the public.

(*b*) It is recommended to amend the Order in Council made the 16th of July, 1920, under the Foreign Animals Importation Ordinance of 1886, so as to allow the importation of cattle from New South Wales, Victoria, and South Australia, subject to the following conditions:—

(1) The inclusion of a second Government Veterinary Officer in the establishment of the Civil Service of the Colony in order that the officer at Suva may always be available if required to supervise quarantine of animals at Suva.

(2) That the importation of cattle from Australia is limited to pure-bred breeding stock.

(3) That the cattle are kept in quarantine at Suva for fourteen days and sprayed twice at intervals of ten days during that period with a reliable arsenical dip.

(4) That everything is ready for the fulfilment of these conditions before the embargo is raised.

(*c*) It is recommended to declare Filaria immitis in dogs an infectious and contagious disease under the Contagious Diseases (Animals) Ordinance in order to give the Government Veterinary Officer the power to destroy badly affected animals in the later stages of the disease, and thus remove what tends to become a public scandal as well as a serious menace to healthy dogs.

(*d*) It is recommended that the Government at their discretion bear the cost of sea-freight in respect of pure-bred entire horses, cattle, and sheep, imported into Fiji for *bona fide* breeding purposes in the Colony.

It is considered that this measure would be the most practicable and economical form of Government aid towards the improvement of stock in Fiji.

There is an important precedent for such a measure in the action of the Union Government of South Africa prior to the European War in entering into an arrangement with certain steamship lines to carry pure-bred stock from the United Kingdom free to any importer resident in South Africa. The concession, if agreed to, should include pure-bred cattle from India and jack-asses from Spain. The Government should reserve the right to refuse the concession where they have reason to think that a proposed importation is not likely to be of general benefit to the stock-breeding industry of the Colony.

(*e*) It is recommended to amend the Contagious Diseases (Animals) Ordinance Amendment Ordinance 1914 at subsection 4 (ii) of section 3, to read: "(ii) For cattle, three pounds."

The market value of a diseased beast in Fiji in no case can exceed three pounds, and, while the maximum amount stands at six pounds, there is a tendency for persons to claim unfair compensation.

D.—*Proposals which may not require legislation.*

(*a*) With reference to the provisionally approved proposal to appoint a second Veterinary Officer for duty at Lautoka, it is suggested that in consideration of his professional services the Colonial Sugar Refining Company might be willing to pay to the Government a proportion of the annual salary of the officer, who would doubtless be called upon to do a substantial amount of work on the Company's plantations in Vitilevu and Vanualevu.

(*b*) Very careful veterinary observation of Indian cattle imported into Fiji will be necessary during the quarantine period to safe-guard the Colony from Surra, a fatal disease of the blood due to trypanosomes, which is endemic in India.

Extensive harm was done in Mauritius to horses and cattle by the introduction of this disease in cattle from India.

It is said that so many animals perished after the introduction of the disease in 1902 that the planting and gathering of crops became impossible, the mortality being 100 per cent. in horses and 25 per cent. in cattle.

It is recommended to inoculate a dog with blood from each imported animal as soon as convenient after landing. In the dog unmistakeable symptoms appear within twenty-one days of inoculation with infected blood.

I am indebted to my former chief, Major-General L. J. Blenkinsop, C.B., D.S.O. (the head of the Army Veterinary Service and late Director of Veterinary Services in India), for drawing my attention to this vital point concerning the importation of Indian cattle.

(*c*) It is recommended that an annual inspection of all cattle in the Colony, with a quarterly inspection if possible of infected herds, and immediate slaughter of all animals showing clinical symptoms of tuberculosis, should be adopted as a veterinary policy for the proper control of tuberculosis and other contagious diseases.

It is pointed out, however, that it will only be possible to carry out this essential policy if two Government Veterinary Officers are available for inspection duty in the country districts for at least four calendar months in each year, and that it is likely that a third Veterinary Officer may be required.

The Contagious Diseases Ordinance, as it stands, permits only qualified veterinary practitioners to order the destruction of animals on account of contagious disease, and I am of opinion that no departure should be made from this policy, because there is no other existing standard whereby the fitness of a person to exercise this power may be safely assessed.

(*d*) It is recommended that every encouragement, including financial assistance if required, should be given by the Government to the promotion of agricultural shows or exhibitions of live-stock, because experience elsewhere teaches us that this enterprise more than any other of the kind tends to raise the standard of cattle in a new country.

Section III.

Reasons why Other Proposals contained in former Reports have been Abandoned.

A.—*Proposal to establish Government-owned Bulls and Stallions at various centres for the use of the public.*

It has seemed advisable not to proceed with this proposal at present for the following reasons:—

(1) It would not be fair to allot bulls to one part of the Colony rather than another, and to deal completely in this respect with so scattered a Colony as Fiji with such poor means of communication would be very costly and could not be undertaken without a substantial increase in the personnel of the Agricultural Department.

(2) The standard of cattle farming is so low and the immediate outlook for the cattle trade is so doubtful, that heavy capital out-lay on a scheme for the improvement of the standard of cattle can hardly be justified at the present time when capital out-lay on improved means of communications is probably what is primarily required to develop trade in general.

B.—*Proposal to establish a Government Stud Farm or Stock Farm for breeding Pedigree Stock.*

It is recommended not to proceed with this proposal now, partly for the reasons given as regards state-owned bulls, and partly because the Dairy Scheme will amply suffice for experimental purposes in this direction for the present.

It is certainly desirable to have a Government Stud Farm for experimental purposes: when the Dairy Scheme is thoroughly established and the Colony has an adequate veterinary service, it may become practicable and advisable to take over one of the Tailevu farms or some other site for a Government Farm. In my opinion, however, the time is not yet ripe.

C.—*Proposal that the Stock Improvement Ordinance of* 1909 *should be administered by means of Committees in Districts.*

Since this proposal was made, provisional approval has been given to the appointment of a second Government Veterinary Officer. Whereas with only one officer it would have been necessary to set up the District Committees, I am of opinion that with two or more veterinary officers in the Colony the Committees will not be required.

With the necessary police assistance and the support of District Commissioners, it has been possible for me to carry out the provisions of the Stock Improvement Ordinance as regards stallions in five months throughout the whole of Vitilevu excepting the province of Ra, and there seems to be no doubt that with two or more veterinary officers the Ordinance as regards stallions could be regularly administered throughout the Colony.

It is stated above that it appears to be not practicable to administer the Ordinance as regards bulls, and in deciding to abandon the proposal to form District Committees it is assumed that this view will be accepted.

It is relevant to offer here a word of warning on the administration of the Ordinance as regards stallions. The intention of the Ordinance is, or at any rate should be, not to castrate all stallions of doubtful suitability, but only to enforce the castration of those which are clearly so degenerated as to be worthless. It is necessary to state, however regretfully, that there exist persons who in order to secure if possible a monopoly of services for their own stallions would like to see the Ordinance so rigorously applied that none but imported pedigree stock should be left to breed from. This is not, or should not be, the way to administer the Ordinance. In every country it is desirable to establish and encourage a strain of useful country-bred horses or ponies, and if anyone doubts whether this can be done in Fiji let him travel to the Fiji towns of Nadle or Vaturu in Nadi or Vatabalavu in Colo West, and, after carefully examining the horses to be found there, ask himself if he has seen a sturdier, hardier type of pony among those of the first generation bred in Fiji from imported sires.

The rule should be to give the country-bred stallion the benefit of any doubt as to its suitability, remembering *that half of successful breeding is feeding*, and that an unlikely looking animal often contains in himself the seed of excellent progeny, only requiring adequate nourishment for a few generations to secure its adequate development. The principle of recessive qualities discovered by Mendel has passed beyond the limitation of theory.

D.—*Proposal to appoint part-time lay Stock Inspectors in the country districts.*

This proposal is with-drawn, because it is considered, after practical experience of the country, that it is impracticable. Travelling is so difficult and the distribution of stock is so scattered that the duties of inspection

could not be carried out satisfactorily in the spare time of any of the men whose services in this capacity would be worth having; a good man is usually a busy man. With the exception of work at the Ports, in connection with the Foreign Animals Importation Ordinance, which can readily be carried out in part-time, it does not appear that the appointment of part-time stock inspectors could be justified, and it is recommended that the item under that heading is omitted from the Estimates of 1921.

Section IV.

Extent and Distribution of Animal Diseases.

The following diseases of animals are found in Fiji:—

1. Tuberculosis of cattle.
2. Nodular-worm disease of cattle and sheep.
3. Ulcerating tumours of the eye and back of cattle and legs of horses.
4. Actinomycosis of cattle.
5. Grease.
6. Mange of horses and dogs.
7. Filariasis of dogs.
8. Ipecachuana poisoning of cattle.
9. Scour of calves and dysentery of cattle.
10. Strangles of horses.
11. Osteoporosis of horses.
12. Debility and malnutrition of cattle.

Tuberculosis.

Tuberculosis of cattle is found throughout the Group varying in extent in accordance chiefly with the following circumstances:—

A. Circumstances favouring spread of tuberculosis.	B. Circumstances that hinder the spread of tuberculosis.
1. Shade of trees and dense herbage.	1. Exposure to sunlight.
2. Heavy rainfall.	2. Light rainfall.
3. Neglect in destroying diseased animals.	3. Early destruction of diseased animals.
4. Over-stocking or close-stocking.	4. Under-stocking or light-stocking.
5. Herding in large mobs.	5. Herding in small lots.

It may be deduced from the above table that it is largely a question of the dry versus the wet belt and that the disease will as a rule be found at its worst in coconut plantations or elsewhere in the wet belt where cattle are run in large mobs.

In a former report the opinion is given that under conditions of systematic inspection and early destruction of clinical cases the disease may be reduced to small proportions. The amount of tuberculosis in Fiji may be estimated at from 2 per cent. in some parts of the dry belt to 20 per cent. in some parts of the wet belt. Individual herds that have been grossly neglected will show a considerably higher percentage, but fortunatetly this is exceptional.

In the wet belt, tuberculosis is found chiefly affecting the lungs. In the dry belt, where the disease runs a more chronic course, it is found often in the form of tumours or abscesses in the throat, at the point of the shoulder, in the flank just in front of the stifle joint, in the scrotum of bullocks, in the udder of cows (rarely) and in the subcutaneous tissue of the brisket.

The characteristic symptom of a tubercular abscess as distinct from any other swelling is that it is hard and that (except in the udder or scrotum)

it is generally freely movable under the skin. An ordinary abscess or tumour is adherent to the skin or is of soft consistency. In case of doubt, plunge a knife into the abscess and observe the contents: if they are of a sulphur or yellow-ochre colour and of a consistency varying from liquid custard to soft cheese it is safe to diagnose tuberculosis.

It is generally believed in Fiji that tuberculosis is chiefly found affecting cattle in the ownership of Indians, but this opinion is erroneous. As a rule the Indian small-holder jealously prevents his cattle from running with those of his neighbour, and thus an effective system of isolation is established which hinders the spread of the disease to a remarkable extent. There will be little trouble in controlling tuberculosis among the cattle on Indian small-holdings; it is in dealing with the large herds of European-owned cattle, running indiscriminately together, that difficulty will be experienced.

In a preliminary report on a brief visit to the Rewa River district in October, 1919, it was stated that pending further clinical evidence I was not disposed to believe that tuberculosis on the Rewa River was as prevalent as generally reported.

Steps have since then been taken to obtain this evidence by means of the systematic inspection of meat killed at Nausori and the records of this work (diligently carried out by Mr. A. E. Nicholl), establish beyond doubt that approximately 20 per cent. of all cattle in the Rewa River area are more or less affected with tuberculosis.

The disease however is as a rule limited to a few nodules in the lungs causing no symptoms during life, having no appreciable effect on nutrition, and seldom affecting the suitability of the carcase for human food.

Nodular-worm Disease.

This disease is caused by the larva of a parasitic worm that penetrates the mucous membrane of the large and small intestine of cattle and sheep, and produces nodules. For a full description of the parasite see the *Agricultural Circular* for January, 1920.

The affection appears to be distributed everywhere throughout the Colony and so far as my observations go its ill-effects are limited as follows:—

1. It may give the final blow to over-stocked, emaciated, or over-worked animals.
2. It causes a chronic diarrhœa in badly affected animals, so that they cannot be fattened.
3. It is unable to obtain a hold on well nourished healthy animals.

Ulcerating Tumours of the Eye and Back of Cattle and Legs of Horses.

This condition is fully discussed in the *Agricultural Circular* for June, in the report on the province of Ba.

It is only desirable to add:—

(1) That further investigation may show the exciting cause to be a larval nematode worm, thereby establishing a relationship to a similar condition in Samoa termed "Tona."

Lieutenant-Colonel H. E. Reid, the Government Veterinary Bacteriologist of New Zealand, in a recent report on a visit to Samoa, states that the "Tona" of that Colony is due to wound-infection with the larva of a parasitic worm.

Actinomycosis of Cattle.

A few cases have been observed. This disease is usually characterised by a hard swelling on the lower jaw or other part of the head accompanied or not by periodic ulceration.

Grease.

This condition is almost entirely limited to horses bred from Clydesdale or Shire strains, *i.e.*, hairy legged animals. For further information see the report on the province of Ba in the *Agricultural Circular* for June, 1920.

Strangles.

This disease is introduced from time to time in shipments of horses from Australia or New Zealand, and its incidence appears to be limited by the extent of infection from this source.

It does not tend to become endemic in Fiji or to cause serious symptoms in infected animals, consequently it suffices to apply quarantine restrictions only to actually diseased animals arriving by sea.

Filariasis of Dogs.

This disease is distributed everywhere throughout the Group. It has been suggested that an island situated as Taveuni is might free itself for some time from the disease by taking the following steps:—

1. On a given date destroy all the dogs on the island and forbid the landing of any dogs from any Pacific Island thenceforth.
2. After six months have elapsed since the date on which all dogs were destroyed, re-stock the island as may be required with dogs imported from New Zealand or Australia.

It seems likely that during the interval of six months all the insect life on Taveuni carrying the infection of the Filaria immitis would become clean, and that the island might remain free from infection for a considerable period. The weak point in the suggestion is that clouds of mosquitos may be carried by certain winds from other islands; if this a fact the experiment would soon fail. If it is not a fact it would probably have some success, because, although a few infected mosquitos would be introduced from time to time by ships, the filaria would not readily be re-established in this manner. It has been pointed out in a former report that individual dogs may be kept free from the disease by protecting them from mosquito attack in various ways, but few people will adopt a measure that requires daily care and repetition to ensure its success.

Extraordinary statements are current in Fiji regarding the alleged virtues of certain remedies as destroyers of the Filaria immitis in dogs, and it may be suggested that those who repose confidence in the remedies should ask themselves the following questions:—

(1) By what means is it possible to introduce into the pulmonary artery and the right side of the heart a sufficient dose of medicine (given by the mouth or trachea) to kill a mass of adult worms in the blood vessels up to ten inches in length and to effect their removal without also killing the dog?

(2) By what means, having overcome the difficulty at (1), is it possible, without any further precaution being taken, for the "cured" dog to remain free from re-infection?

The latter question is suggested by the fact that all who have "cured" their dogs are firm on the point that the dog lived happily ever afterwards. While it would not become a scientific worker to dispute the possibility of finding satisfactory answers to the above questions, it is thought that the explanation of the circumstance may be that besides the Filaria immitis there is another parasitic affection of dogs in Fiji caused by the presence in the bronchial tubes of a variety of thread-worm. This condition in other animals often responds readily to treatment by the intra-tracheal injection

of turpentine, creasote, and other remedies, which it is understood are the basis of the alleged "cure" for Filaria immitis of dogs in Fiji.

Recent research work, carried out in Queensland by direction of the Australian Institute of Tropical Medicine, proves that the Filaria immitis may be conveyed from one dog to another by means of fleas. To protect dogs with certainty therefore, it would appear necessary, not only to make their sleeping quarters mosquito-proof, but to keep the animals free from fleas by dusting them regularly with pyrethrum powder, and periodically washing the kennel with solution of corrosive sublimate 1 in 300. See also Pamphlet No. 33, Department of Agriculture, Fiji.

Mange.

The disease appears to be found only affecting horses in the dry belt. It appears to be only slightly contagious as compared with the disease in other countries, consequently there should be no great difficulty in stamping it out. For particulars of treatment see the *Agricultural Circular* for June, 1920.

Scour in Calves.

The incidence of this disease appears to be limited to areas and herds where the feeding arrangements are inadequate and where the land is over-stocked with horses and cattle. Horses should not be run on closely stocked land where calves are endeavouring to graze.

Apart from the bacillary flora contained in the excrement of the horse which in certain circumstances may be dangerous to young calves, the horse is an epicure and a close feeder and cuts off with his teeth near the ground, those tender morsels of grass which otherwise would grow long enough to afford nutritious grazing for cattle. As a rule then horses and cattle should not be grazed together.

When an outbreak occurs remove all healthy stock immediately to fresh pastures and water, and let the infected area lie fallow for at least three months.

Osteoporosis in Horses.

This disease is found affecting a considerable proportion of all horses that have been running from foals on Para grass, and is absolutely restricted to this incidence. (See also *Agricultural Circular* for March and June, 1920.)

The symptoms to the naked eye are most commonly a bulging or enlargement of the bones of the face and a general appearance of unthriftiness. In more advanced cases there is stiffness of gait or even paralysis of one or more legs. There are few diseases of which the cause has been more disputed, but it seems proved that the form of the affection in Fiji is due to a deficiency in Para grass growing on alluvial flats, of some element required for the growth and maintenance of bone in horses. This element may be lime or it may be a vitamine; the Government Chemist is now carrying out analyses of Para grass that may help in establishing a definite conclusion. In practice the disease may be prevented by feeding a daily ration of cow-pea to each young horse running on Para grass. A ration of molasses also acts as a preventive.

Debility and Malnutrition of Cattle.

These conditions unfortunately are wide-spread in Fiji. They are the inevitable result of over-stocking, under-feeding, and of running cattle on land where the pasture has little feeding value. The immediate effect is emaciation, but the ultimate result is the degeneration and dwarfing of all stock subjected to these adverse circumstances and a consequent lowering of the standard wherever the cattle go. The Stock Improvement Ordinance of 1909 was based as regards bulls on the assumption that lack of attention

to the matter of breeding was chiefly responsible for the degeneration of cattle in Fiji, but it appears from my investigations that under-feeding is by far the most important factor.

Section V.

A Fore-cast of the Development of the Live-stock Industry in Fiji.

The future of the cattle trade in Fiji depends upon the following factors:—

1. Practical demonstration on a sufficient scale that hill land in the wet belt of Fiji will produce permanent pasture that will pay for weeding.
2. The discovery of suitable grasses for upland pasture.
3. In proportion to the grazing value of certain lands, the cost of clearing, fencing, planting, and draining those lands and keeping them free from *Clidemia hirta* and other noxious weeds.
4. The establishing of a remunerative opening by means of a freezing or canning factory whereby Fiji may have access to the world's markets.
5. Creation and improvement of roads.
6. The amount of suitable land in fair-sized lots, conveniently situated as regards means of communication, which will be readily available for sale or long lease to intending graziers at reasonable cost.
7. The practicability ultimately of applying a Noxious Weed Ordinance to *Clidemia hirta*.

The Tailevu Dairy Scheme should do much to settle some of the foregoing questions and on this account alone the scheme appears to be justified. If it succeeds it will be the means of opening up a large area in the wet belt for cattle farming; if it fails it will serve to direct enterprise and capital into more hopeful channels, and thereby save many speculators in the future from loss.

For a proper understanding of the pastoral problems of Fiji as compared with Australia, it must be realised that cattle-ranching on a free-and-easy ring-fence or a boundary-riding basis is quite impossible here. Those great areas of good natural grazing which make big-scale ranching profitable in other countries are not found in Fiji. Dangerous bog, impenetrable forest, sterile hill-land, entirely innutritious grasses, and other adverse features are inseparable from any considerable stretch of country in Fiji. Consequently, fencing in relatively small paddocks, clearing, planting and constant weeding, are essential to success in any grazing undertaking in this country. If the necessary capital is not available for these operations the enterprise should be avoided because certain loss will follow their neglect.

Fiji is remarkably free from diseases of cattle and I am perfectly satisfied after exhaustive practical investigation that under proper conditions of feeding and farming generally, cattle will thrive as well in Fiji as in any other country. It is clear from observations that a cross between the Zebu (Indian Ox) and a European strain of cattle will prove the most suitable breed for Fiji excepting for high grade dairy farming in which a pure strain of Holstein is likely to give the best results.

The half-bred Zebus have these advantages in a tropical country: -

(1) They make by far the best working oxen.
(2) They are much more resistant to disease.
(3) They better withstand adverse conditions of care and feeding.

They make as good beef as other breeds and the quality and quantity of milk produced by the cows is at least equal to that of the ordinary Fiji cow.

Any future that Fiji may have as a beef-producing country on a large scale lies in the wet belt: having in view all those difficulties implied in

the conditional factors set forth at the beginning of this section, it would be unreasonable to be optimistic, just as it would be unscientific and foolish to be pessimistic. None of the difficulties is insuperable, but each of them must be overcome and in the aggregate this means a very great deal of work and enterprise which must be undertaken before optimism can rest upon a basis of fact.

The dry belt of Fiji offers no hope of further development for cattle; it is already fully stocked and in many places over-stocked with cattle and horses, and the available grazing area is steadily decreasing before the invasion of guava.

I think that the dry belt offers good prospect of development as sheep country, but further investigation is needed to establish whether or not ewes are profitably fertile in Fiji. There seems to be no other circumstance that may interfere with success; the existing sheep are healthy, appear to thrive on pasture that cannot support cattle, and carry a fair crop of wool.

It is difficult for me to assess the commercial possibilities of pig production in Fiji, because I have not been able to obtain any evidence of pig culture on modern lines. The present-day pig is a highly specialised product calling for a considerable amount of care and skill in its management if those qualities that make it a paying proposition are to be maintained and propagated. Without that care and skill, fertility diminishes, mortality increases, maturity is delayed, and profit vanishes.

Here again the Dairy Scheme will prove most valuable if the present intention to combine scientific pig-keeping with the main object is carried out as it should be, because thereby it will become possible to ascertain exactly what is the commercial value of the bacon industry in Fiji. There seems to be every chance of success, because pigs undoubtedly thrive under most unlikely conditions in Fiji and there is no evidence of the existence in the Colony of any specific diseases of pigs. Further it is easy to grow a great variety of suitable starch-containing food which with the addition of skim-milk is capable of forming in the right proportions an ideal and inexpensive dietary.

As regards horses it is considered that Fiji can supply herself with both horses and mules, provided reasonable care is observed in the breeding and feeding of foals.

Draught horses are chiefly in demand and these should be bred from Suffolk Punch or Percheron strains.

Excellent light mules could be bred by mating good imported jackasses with ordinary country bred mares.

The best existing pasture for horse breeding is the trefoil and mixed herbage found in the mountain valleys and on some uplands in the dry belt. The alluvial flats are unsuitable unless a grain ration is fed.

It may be found on examining all the circumstances that it does not pay to breed horses in Fiji when a great horse breeding country like Australia is near at hand and ready to supply any number of animals at a moderate cost. This may be so, but at present prices it should pay well to breed mules which in my opinion are more suitable for the conditions of plantation work.

Finally, I desire to express my sincere thanks to all those who have helped me in many ways to carry out my investigations in Fiji. Hospitality and assistance of all sorts has been freely given to me, and any useful conclusions that I may have been able to record are due as much to the accumulated experience and sound common-sense of planters and others as to my own observations.

REPORT ON MISSION TO TAHITI TO INVESTIGATE THE PARASITES OF THE COCONUT SCALE WITH A VIEW TO THEIR INTRODUCTION INTO FIJI.

By H. W. Simmonds, F.E.S.

Introduction.

I have the honour to submit to you my report on my recent mission to Tahiti in search of the parasite of the coconut scale *Aspidiotus destructor* mentioned by Doane as having done such good work in that group.

I had little difficulty in finding this insect and also a second and probably new species, which latter reached this Colony alive in some numbers.

During my journey a number of interesting subjects came under my notice, among which the *Oviri* coconut of Tahiti may prove of considerable economic importance.

Three weeks were spent in the Cook Islands, and in consequence of my observations on the citrus fruit industry there, I made certain unofficial representations to the New Zealand Administration which are mentioned in the enclosed report.

I regret that I experienced exceptionally severe weather when passing through New Zealand with somewhat disastrous results to my last and most important consignment of *Aspidiotus* parasites.

The whole trip was exceedingly interesting and I trust will eventually prove of important economic value.

Report.

Acting in accordance with instructions received I left Suva on 19th February by the s.s. "Navua" en route for Tahiti, to investigate the condition of the coconut palms there in view of the outbreak of scale disease in that group, and to try to find the *Chalcid* parasite reported by Doane as having done much to check the ravages of the disease in that group, and if possible to endeavour to transport this insect to Fiji, where the scale *Aspidiotus destructor* had recentiy appeared, and was causing much anxiety to planters.

I duly arrived in New Zealand on the 24th February and caught the R.M.S. "Tofua" on the 12th March arriving at Raratonga on the 18th and Papeete on the 20th March.

General Appearance of Coconut Palms in Tahiti.

Viewed from a distance the general appearance of coconut palms in Tahiti was good, especially in the valleys. At some places the outside leaves showed yellow and investigation showed that in such cases the plants generally grew on shallow soil on hill slopes, and that the dying off of the leaves was purely the mechanical results of drought. A similar result was brought about by swamp conditions at certain places. In a few instances however disease proved to be the cause; the most fatal in its immediate effects being caused by the beetle *Sphenophorus obscurus*.

Most of the trees were planted far too closely together and little or no cultivation was as a rule attempted, and in many cases a number of the nuts must be lost in falling in the dense jungle growing beneath the trees. Nevertheless many good heads of nuts were observed; trees with 100 to 150 nuts on being not uncommon.

History of Scale Disease.

At Papeete I had little difficulty in locating several patches of palms affected by the scale, which seems to have first occurred some 25 to 26 years

ago, and was probably brought in with plants in a small experimental garden established here about that time.

From this spot *Aspidiotus* gradually spread, following the islands in the direction of the trade wind with very disastrous results. A few miles from Papeete is a group of islands forming an atoll called Tetioroa and now owned by Dr. Williams. This gentleman finding many of his trees dying and dead from the scale sent specimens to Doane of United States of America, both from Tetioroa and the mainland for examination. Doane found traces of parasitic attacks on the *Aspidiotus* and in consequence of this report Dr. Williams induced Doane to visit Tahiti in August, 1908. During this visit he discovered and subsequently described a *Chalcid* parasite as doing valuable work, and also reported on other insects affecting the coconut palms, and finally expressed the opinion that the parasite was rapidly bringing the scale under control; which optimistic prophecy has undoubtedly been justified.

Present Distribution of *A. Destructor* in Tahiti.

So far as the present distribution of *A. destructor* is concerned it seems almost confined to the coast and was most prevalent in those places exposed to the prevailing winds. In such places I found patches containing numbers of trees which were very badly attacked. I think it probable that the strong winds in such places give a measure of protection to the scale against its very frail winged enemies.

Enemies to *A. destructor*.

Careful examination of many of the older scales showed a perforation caused by the emergence of some parasite and microscopic examination of the younger ones showed the presence of a *Hymenopterous* parasite in all stages of its existence, whilst a low power glass showed numbers of the perfect insects running about on the palm itself. I had little difficulty in breeding this parasite out in numbers under observation, but found it very frail seldom living more than two or three days in captivity. It was exceedingly minute with a brownish thorax and yellow and brown striped abdomen, and took about six weeks to complete the cycle of its existence.

At the base of the stalks of the coconut leaves were large numbers of another scale a *Chionaspis* and fully 75 per cent. of these were parasitised. Numbers of these parasites were bred out and seemed to be identical with the species attacking the *Aspidiotus*. So that it seems to me probable that as the *Chionaspis* was in Tahiti previous to the introduction of the *Aspidiotus* and under control; that the *Chalcid* was there before the arrival of the *Aspidiotus* and has adapted itself to the new arrival; the more so that I have reason to believe I also bred the same *Chalcid* out of a *Diaspis* scale. Some palms imported from Flint Island some 400 miles to the north I found to be very badly attacked by *A. destructor*, and these in turn were subjected to another *Hymenopterous* enemy, which I also found in a few other trees close by; and which may therefore be a recent importation.

This species was larger than the other and of a clear canary yellow with bluish opalescent wings. I succeeded in breeding a number out and found them much hardier than the first species.

In addition to these internal parasites I am confident that *Aspidiotus destructor* has a number of external enemies, the principal of which is undoubtedly a species of lacewing fly, which was very abundant, whilst ladybirds although scarce doubtless play their part.

Other Diseases of Coconuts.

Coccidæ.—In addition to *A. destructor* and the *Chionaspis* mentioned above another scale, a *Diaspis*, was not uncommon, and I bred two *Chalcids* apparently identical with those from *A. destructor* which I believe came from this species. Mealy bugs were almost always present in numbers, but seldom exposed in the open, so that doubtless this insect has some enemy which attacks it when not under cover.

Lepidoptera.—Many of the trees showed patches of brown, where the lower surface had been eaten away, and only the thin upper epidermis left. These patches were less than those caused by the Fijian *Levuana iridescens*, and proved to be the work of the larva of a small brown *tineid* moth. Next to *Aspidiotus destructor* this is probably the worst enemy that coconut planters have to fear in Tahiti, and on some estates it must do a very large amount of damage. In the neighbourhood of Papeete a *Hymenopterous* parasite was doing good work however against this insect. It is a *Chalcid*, black in colour, with yellow tibiæ and much swollen femora on the hind legs. A second moth of a beautiful silvery white colour with a yellow stripe down the centre of the front wings was also very abundant. I do not think however this species attacks healthy leaves, but confines itself to those suffering from the previous attacks of scale, fungus, or other diseases.

Coleoptera.—Doane records two beetles, viz., *Sphenophorus obscurus* and *Calandra taitensis* as doing damage. Of these I only came across the former which also does much damage to sugar-cane. When viewed from the ground trees suffering from this beetle appeared to be very sick. Numbers of the leaves were brown and dead, whilst others still green hung limply down. A number of the younger fronds were cut off a third or a quarter their length up and gave the appearance of having been scorched off by fire, and in others again many of the green leaflets failed to open, but adhered to the mid rib.

Upon felling a tree many of the leaves showed gummy exudations in the mid rib whilst the tissue beneath was black and semi liquid. Within this rotten tissue one found the borings containing the larvæ, cocoons, and pupæ of the beetle.

The bud and whole central portion of the tree was unhealthy with a certain amount of bleeding, and vast numbers of mealy bugs (these latter attended by ants) were present. No unpleasant smell however was noticed and no signs of bud-rot appeared to be present.

I think the habit of using climbing irons and cutting steps in the trees which is much practised here must be very detrimental to the trees and lead to beetle attack in many instances. I am inclined to think that *S. obscurus* only attacks those trees in which from some cause a certain amount of fermentation of the sap is taking place such as would be caused by some slight mechanical injury.

Other Diseases.

The only other diseases noticed were fungoid and these did little harm, only apparently attacking the older dying leaves. The most important of these was kindly identified for me by the Superintendent of Agriculture as *Graphiola cocoina* (Pat).

Reference Specimens.

Specimens of all the economic insects observed were collected and brought back in duplicate as far as possible for identification and reference. Diseased tissue was collected and placed in formalin, whilst slides were made of the smaller *Chalcids* showing both the perfect insect and the earlier stage within the scale.

Attempts to Transport Chalcids to Fiji.

On the 18th March, 14th April, and 20th April, I forwarded boxes containing tubes of parasitised *Aspidiotus* to Suva. Of these the first box contained only the smaller species and all arrived dead. Of the two latter consignments those tubes containing the smaller were all apparently dead, but the larger yellow species arrived and were duly liberated at Nasinu.

On 22nd May, I sent three coconut palms on which the scale was attacked by the smaller *Chalcid*. These arrived on 13th June and were planted out at Moturiki. Unfortunately here also a large number of the scales had dried up en route, and it is very doubtful whether the smaller *Chalcid* arrived in sufficient numbers to ensure success.

On 24th June, I left Papeete with four palms well infected with both species. These travelled well to New Zealand, where a wait of three weeks was experienced. Here the palms were placed under cover, but despite this the last week proved disastrous with sharp frost, the thermometer falling to 27° Fahr. one night. I finally reached Suva on 31st July, to find one palm dead and another almost so, whilst on the two palms still alive the majority of the scales appeared to be dead. Nevertheless despite the small quantity of material which had withstood the latter portion of the journey alive I found perfect insects of both species which had emerged after arrival. Whether in sufficient numbers to inoculate the scale infected trees that had been placed with the imported ones is as yet uncertain. One matter that did not help in the transportation of the plants was the large portion that had to be cut away from each to avoid the danger of introducing other pests, as I noticed that each palm died back considerably from the point where I had to cut the foliage.

On 10th and 11th August, I visited Moturiki, where the first consignments had been liberated. I found the local coconuts very badly infected with scale, whilst two out of the three imported palms were dead. This third had a small amount of scale alive, but I could find no signs of parasitism. Doane records some unknown agency as attacking the scales from outside and this I had often observed and thought might possibly be lace-wing flies. Whatever this agency is it had been at work on this imported palm although I saw no signs of its attacks on the surrounding diseased trees.

On 12th August, I visited Nasinu, where I found scale scarce. It was here that the larger yellow *Chalcid* was liberated alive and I was fortunate in finding one perfect example. This points to its having established itself here as there has been time for two generations since the first batch were liberated, I also saw one specimen that looked like the smaller brown species. Unfortunately this escaped before I could be quite positive in my identification. We were unfortunate in the exceptionally cold winter this year in New Zealand, so that the numbers of parasites which arrived were small and may not finally establish themselves. It would be better to consign them in the summer or even would probably pay to divert an oil schooner from 'Frisco, which would cost £400 or £500, but would enable the palms to travel on deck and so give the *Chalcid* an opportunity to reinfect the scale as they emerged. As matters stand at present I have little doubt, but that the larger yellow species has made good at Nasinu, but it will be some considerable time before any thing is likely to be known as to the smaller species which arrived in very small numbers and which owing to its apparent general feeding habits is likely to be the more valuable to us.

Notwithstanding the fact that it is probable from the above that the larger yellow *Chalcid* has established itself at Nasinu, it seems to me that the Government would probably be well advised to obtain a further consignment

which if brought in now in the hot season should arrive in good order and in numbers even if brought *via* New Zealand.

Citrus Industry and Other Interests in the Cook Group.

Having a wait of a month after the shipment of the three palms from Tahiti, on 22nd May before I could ship the balance of my trees, I obtained authority to visit the Cook Islands, where the banana beetle was causing a good deal of trouble. This beetle was said to have been introduced from Fiji, but as it is also present in Tahiti may have been brought in from that group.

It is now doing considerable damage especially amongst the so-called wild mountain species the "Fei" of Tahiti. With the table varieties Mr. Reid, the Government Orchard Instructor, informed me that they found that if the suckers in planting out are taken from young plants they are generally free from this trouble, and that by taking care in this respect the difficulty can be largely overcome.

The principal exports from Rarotonga are oranges, tomatoes, and coconuts. The first of these grow practically wild everywhere, and no pruning or cultivation seems to be attempted. Lichen is present and does damage and two scales a *Lecanium* and *Mytilaspis citri* also occur. From both of these I bred *Chalcid* parasites. *Aphis* which is controlled by ladybird and *Syrphis* flies occurs, whilst mealy bug controlled by lacewing does damage.

The worst pest is undoubtedly the fruit fly *Dacus rarotongensis*. This insect does not seem to have been present formerly, whilst it has only quite recently spread to Mauke and Mangaia, two other islands of the group. It is now exceedingly common, living on guava and other wild fruits and attacking oranges in the season. In view of its apparent recent introduction, I think it will prove to be an undiscovered species indigenous to the Indo-Australian region and Mr. Reid suggested that possibly returning native missionaries may have brought it with them from New Guinea, which I think is extremely probable.

The method adopted in Rarotonga so far as export fruit is concerned is to set aside a couple of days for picking, and some ten days before the New Zealand steamer is due to sail. The fruit is then stored in sheds until a couple of days before the boat leaves when it is repacked and the attacked fruit which is then easily seen is discarded. As the fruit is brought up to the wharf the fruit inspector selects two or three cases from each load which are opened and should he find fly infected fruit the whole consignment is condemned. Fruit from Rarotonga and Raiatea is fumigated before shipment on account of scale. Ripe coconuts in Rarotonga sometimes suffer from the attack of one or two species of another fly, which whilst not common completely destroys the meat of any nut attacked. The fly, of which there seem to be two forms, lays its eggs in nuts which have been damaged in falling or possibly have even only lost their calyx. Upon hatching the maggots make their way to the eye and so into the nut, which they quickly make into a foul smelling seething mass of slime and maggots. Accompanying this fly are generally to be found number of larvæ of *Drosophila* and fruit eating beetles. It is not certain which first makes the entry to the nut, but in view of the powers of disolving tissue possessed by certain fly maggots I think it probable that it is the fly which is able to penetrate the hard skin of the eye of the nut and that the *Drosophila* and beetles are secondary invaders. When full grown the maggots are about five-eighths of an inch in length and of two colours, one dull white the other dirty green. According to Mr. Reid to whose kindness I am indebted for bringing this insect to my notice the latter form produces a fly with clouded wings,

the former being clear. Larvæ of both were obtained and left with Mr. Reid, who kindly consented to breed them out and forward specimens. Mr. Harnett, Fruit Inspector of Auckland, informs me that the same or a similar fly occurs in Samoa.

In consequence of what I had seen of the fruit fly in Rarotonga, I decided to unofficially approach the Department of Horticulture in New Zealand, to see if something could not be done to satisfy that Government as to the clearness from disease of our Fijian citrus fruit, and so reopen that market for our exports. I therefore went to and saw Messrs. Kirk and Campbell of that Department and suggested that if we were to erect sheds and have all citrus fruit brought in and stored for eight or ten days before shipment, and then packed and graded under white supervision that they should accept such a certificate instead of the present one demanding that no fly occurs within a mile of the orchard where fruit is grown, and which it is impossible honestly now to give. They informed me unofficially that not only would they support such a proposal, but that we could rely upon its being approved should we decide to put it forward officially. In view of the high quality of Fijian mandarins, and the suitability of this culture to white growers, I hope that we shall again see the New Zealand market opened to us. I have to take this opportunity of thanking Mr. Reid, the Government Orchard Instructor of Rarotonga for much kind assistance and information freely given.

The Oviri Coconut.

Whilst in Tahiti my attention was called to a variety of coconuts called by the natives *Oviri*. This nut is said to possess decided astringent properties not only in the roots (a decoction of which is used as a remedy against dysentery) but also in the whole plant.

The foliage is said to be seldom attacked by scale or insect larvæ, doubtless on account of this astringency. The nuts themselves are green, of medium size and decidedly angular in shape; whilst the leaves looked very green and appeared quite free, in those that I saw, from insect troubles. The trees were generally only moderate bearers, but one I saw was undoubtedly prolific. It seemed to me that this variety might also possibly prove to be immune or partially immune to our leaf eating moth *Levuana iridescens*, and I therefore forwarded on 22nd May a bag containing a number of the seed nuts. These were either stolen or lost in transit, and did not reach Suva. Before leaving I was only able to obtain a further two and these I brought with me, but before my departure I arranged that a further half-dozen should be obtained and forwarded as early as possible. This experiment will be watched with much interest, but as these nuts are likely to be cross fertilised with typical forms they may not in themselves show the astringent properties, and it may then be necessary to wait a generation before a definite verdict can be pronounced.

Thanks.

I have to take this opportunity of expressing my thanks to Messrs. A. B. Donald and Company of Auckland and to their Managers Messrs. G. E. B. Sharood and Coppenrah, who gave invaluable assistance throughout all the time I was in Tahiti. Mr. Gooding of Maxwell and Company, who kindly supplied me with *Oviri* nuts. Mr. Pecastaing of Atimoamo for kind hospitality and gift of parasitised material, and Dr. Williams, who gave me much useful information and advice. I am also much indebted to Mr. Harnett, Fruit Inspector of Auckland who took charge of my palms for me whilst in transit in Auckland.

EXTRACTS FROM REPORTS OF INSPECTORS.

INSPECTION OF FRUIT.

The Inspector of Produce reports that by the s.s. "Atua" on 10th July there were shipped to Auckland bananas equivalent to 27,589 bunches. The rejections amounted to 7·9 per cent. of the shipment. Ripe fruit was scarce in the punts, rejections being principally for loose packing and immature fruit. Nos. 1 and 3 holds were not very clean, being lined with cement and coal dust. The fruit was well stowed and carefully handled, and dunnage was ample and ventilatilation good. Salt water used in hosing down the steamer's decks was permitted to run into several punts.

The s.s. "Levuka" on 20th July took away 6,790 bunches of bananas and 4,593 cases for Melbourne, and 2,029 bunches and 1,369 cases for Sydney, equivalent to a total of 20,743 bunches. Rejections amounted to 10·9 per cent. of the shipment; the majority of rejections were cases of fruit packed too loosely. The fruit was of very fair quality and it included a cutter-load of excellent fruit from Sigatoka. The fruit was carefully handled and stowed, dunnage being plentiful and ventilation spaces ample. The temperature of the cold air supply was 18°F when loading commenced. Pending information from Australia as to certain requirements of the Commonwealth Authorities regarding fumigation, each shipper handed in an affidavit that his fruit had been properly fumigated, which documents were forwarded to the Federal Quarantine (Plants) Officers.

COCONUT SCALE.

Mr. M. A. Forsyth, Inspector of Plantations, Levuka, reports for June that no spread of the scale is noticeable on Ovalau, but although Bureta is looking better it is still badly infected. In regard to other districts there is nothing to report. An area has been prepared for spraying as a possible method of control on a large scale, and spraying apparatus for the purpose is to hand. Moturiki is still badly affected, and work has been more or less suspended since the palms from Tahiti were planted out by the Superintendent of Agriculture.

Mr. H. V. G. Rivington reports that he visited seven islands in the Yasawa Groups during the month, viz., Yasawarara, Namula, Tarewa, Matacewalevu, Yangeta, Kaviti and Waya. Coconut scale was found at five of these islands, viz., Yasawarara, Malacewalevu, Yangeta, Naviti and Waya. The palms are only recovering from the effects of the storm of last year, and this probably accounted for the fact that scale was very scarce, being found principally on the nuts and the bases of the leafstalks, practically none being found on the leaves. At only one place did the scale appear to be very plentiful.

NOOGOORA BURR.

Mr. H. V. G. Rivington reports that certain patches of burr in the upper Ba river land have been cleared and the weed burned. The owner of one patch who had previously not been seen was now found and the weed had been cut on his land and the land ploughed. A few plants had again appeared and work of clearing this was in progress. A patch on a plantation in the neighbourhood had been cleared away, but the plants had not been burned. Subsequently the owner's attention was called to it and the necessity pointed out for eradicating young plants as they appear. Patches of burr on Fijian land had been pulled up, but the plants had not been

burned. Orders were issued. Two other European estates and adjoining Indian land, which had previously been found to be infested with the weed were inspected without the burr being found. Notice was given to the owners of the tramline in this vicinity to clear away certain patches within eight days.

Tavua.—A small patch of burr was seen at an European plantation stacked ready for burning, no living plants being found here or another estate where the plant was said to have existed previously. Burr plants were found on an estate near Tavua, and the attention of the management called to it.

Tavua—Rakiraki.—At Draunivi and Tongaveri considerable patches of the burr were found. Orders were given for their eradication. A few young plants were found in two adjoining estates, work of eradication being in progress. Approaching Vaileka, burr was found on land occupied by Indians. No burr was found at Penang or along the road to Ellington. The Buli of the district in which the extensive patches, previously mentioned, near Tongaveri was seen and stated he had issued orders to the natives concerned to clear away the burr. Mr. Rivington supervised the work of eradication during four days and saw it completed.

INSPECTION OF VESSELS.

The following shows list the number of vessels inspected during the month of July under the Diseases of Plants Ordinance 1913 Regulations, and the number of cases in which material was destroyed:—

Port.	*No of vessels inspected.*	*Cases in which material was destroyed.*
Suva	8	—
Levuka	87	27
Lautoka	12	—

DEPARTMENTAL NOTES.

Captain W. N. Faddy, M.C., Inspector of Produce has resigned.

Mr. W. Clifford, Temporary Inspector of Poantations has resigned.

Mr. Clifford has proceeded to New Zealand and Australia in connection with the acquisition of machinery for the Tailevu Butter Factory.

Mr. H. V. G. Rivington, Inspector of Plantations, has returned from a visit to the North coast of Vitilevu inspecting for Noogoora Burr. Mr. Rivington also visited the Yasawas Group.

A quarantine station for imported stock is being constructed on the Tamavua river. The station is being equipped with applicances and material for washing imported stock, and during their stay in quarantine the necessary tests for detecting the presence of certain diseases will be carried out.

Miss E. Thomas, Sixth Class Clerk, has been granted four months leave from 13th July.

NOTICE TO MAIZE GROWERS AND SHIPPERS.

The New Zealand Government has drawn the attention of the Government of Fiji to the unsatisfactory condition of several recent shipments of maize from Fiji, the chief objection being due to the grain showing signs of the attacks of the maize moth, the larvæ of which live within the maize seed in much the same way as the corn weevil.

Fumigation will kill the insects, but owning to their position within the kernel, the treatment must be continued for a long time and the space in which the maize is fumigated must be sufficiently air-tight to retain the gas long enough to enable the poison to reach the insects. Carbon disulphide vapour will probably be found more effective than hydrocyanic acid for this pest. Great care is needed in handling this material which is a liquid which rapidly turns to vapour, since its vapour forms an explosive mixture with air and it is a powerful poison.

It will be seen that to free maize from insect pests is a very troublesome proceeding, attended by both expense and danger. Persons interested in the production or export of maize would doubtless prefer some method of preventing the attacks of the pests. It is found that hard dry maize is less liable to the attacks of pests than soft maize containing more moisture, hence growers or shippers would be well advised to dry the grain as quickly as possible after it is ripe and to make sure that it is really dry. If intended for shipment it should be shipped away as soon as possible. All maize intended for export should be fumigated, and all buildings used for sortage purposes should be fumigated at intervals.

Shippers and others interested in the matter are asked to bring these suggestions to the notice of any small growers with whom they deal.

C. H. Knowles.

OIL MILL AT PAPEETE.

A Note by H. W. Simmonds.

A considerable proportion of the Eastern Pacific Copra is crushed locally at Papeete, where one of the San Francisco firms have a crushing mill. The shooks for forming the barrels in which the oil is exported are imported from America and put together locally. They are then painted with some proofing material internally and filled with the oil. The Manager, Mr. Wright tells me that the meal after the oil is expressed forms about 30 per cent. to 35 per cent. of the total weight of copra and contains roughly 2 per cent. of oil. It is pressed into cakes when it forms a most valuable cattle and pig food, and is largely sought after by the Chinese and also for export to New Zealand.

By using the cake locally almost the whole of the mineral contents of the nuts are returned to the soil and I would suggest that the time is ripe when in our more closely cultivated coconut districts co-operate mills might be established. The suppliers of copra receiving the meal back; thus enabling them to run a far larger number of stock and also enriching their lands.